BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

(12) UK Patent Application (19) GB (11) 2 298 553 (13) A

(43) Date of A Publication 04.09.1996

(21) Application No 9603562.1

(22) Date of Filing 20.02.1996

(30) Priority Data
(31) 9503352 (32) 21.02.1995 (33) GB

(71) Applicant(s)
Robert William Moore
5 Pen Yr Allt Rheola, RESOLVEN,
West Glamorganshire, SA11 4DS, United Kingdom

Glyn Sinnett
25 Heol-y-Felin, Seven Sisters, NEATH,
West Glamorgan, SA10 9BH, United Kingdom

(72) Inventor(s)
Robert William Moore
Glyn Sinnett

(74) Agent and/or Address for Service
Urquhart-Dykes & Lord
Three Trinity Court, 21-27 Newport Road, CARDIFF,
CF2 1AA, United Kingdom

(51) INT CL^6
H02J 13/00 , G08B 17/10 25/06 , H04B 3/54 , H05B 37/02

(52) UK CL (Edition O)
H4R RTSR R10B
G4H HRBR HRBS HRCR HRCS H1A H13F H14A H14D
U1S S1935 S2192

(56) Documents Cited
GB 2197568 A GB 2083301 A EP 0645870 A1
WO 93/17482 A WO 92/06552 A1 WO 80/01024 A1
US 4719446 A

(58) Field of Search
UK CL (Edition O) G4H HRCR HRCS , H2H HLL4 HSL HSS , H4R RTC RTSR
INT CL^6 G08B 25/06 , H02J 3/14 13/00 , H04B 3/54 , H05B 37/00 37/02 39/00 39/02 39/04 39/06
ONLINE : WPI

(54) **Remote control system; smoke alarms combined with lights**

(57) A remote control system has a control unit 10 which interrupts the mains AC waveform for a predetermined period immediately following a current reversal, and a detector 13 which senses the interruption to control a load 14, particularly a light that is connected to a mains powered smoke alarm assembly 11 which replaces a ceiling rose. The control unit 10 replaces a wall box switch and may selectively insert an interruption in each positive half cycle, the light 14 being on in the absence of such interruptions and turned off when an interruption is sensed. An interruption may additionally be inserted at the start of each negative half cycle, such interruptions being detected to provide an additional control function.

Alternatively, control may be dependent on the duration of the interruption. A master interconnect unit (40, Fig.5) may create permanent 60 microsecond interruptions at the start of each positive half cycle, the master unit (40) feeding a plurality of smoke alarm and light systems each associated with a respective control unit 10 which selectively lengthens the interruptions, the light being turned off in response to detection of the longer interruption. If a smoke alarm detects smoke, it applies a DC alarm voltage to the mains wiring in the period when the supply is interrupted. On detection of this alarm voltage, the master unit (40) lengthens the interruptions even further, in response to which all the alarms 11 enter a test mode in which their sounders and lights 14 operate.

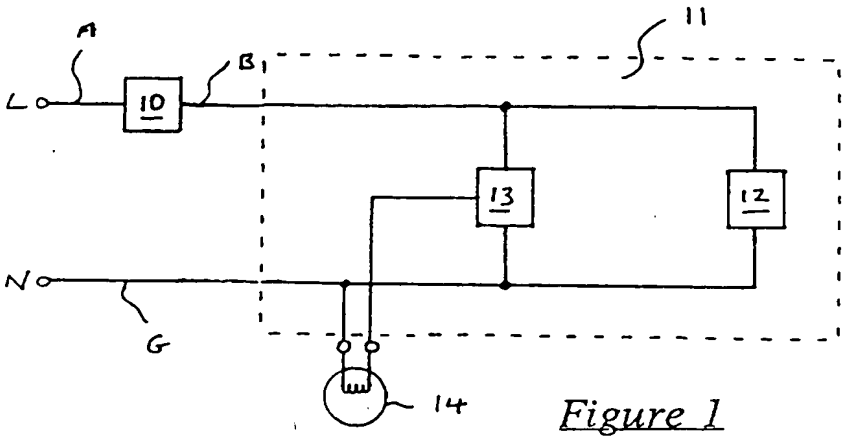


Figure 1

GB 2 298 553 A

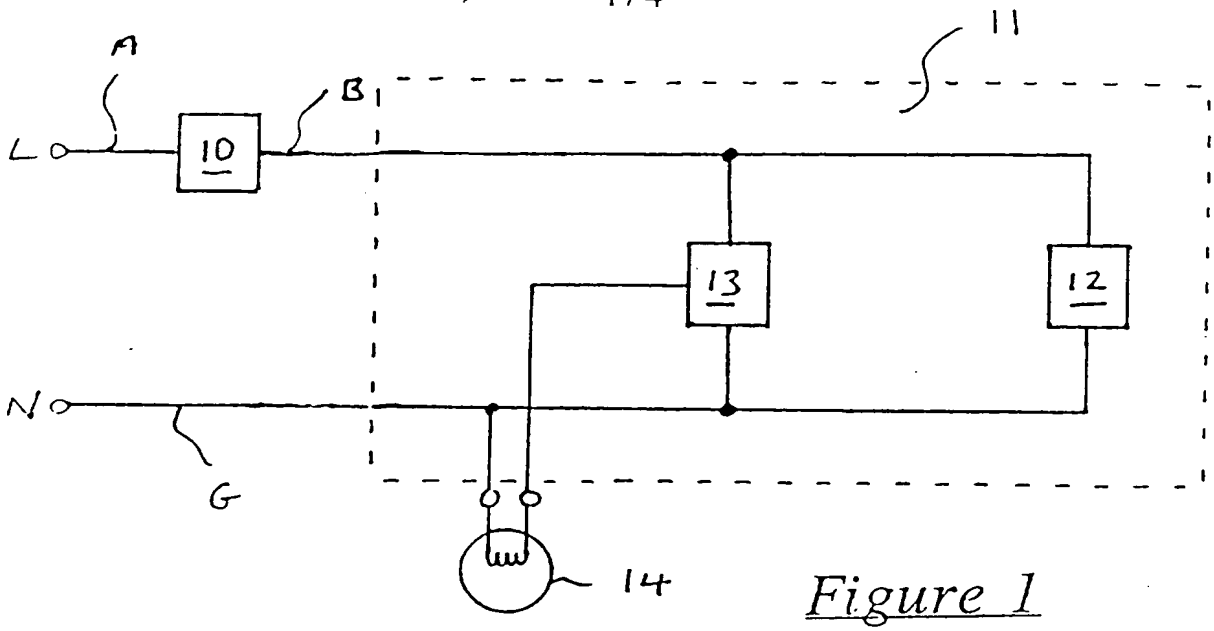


Figure 1

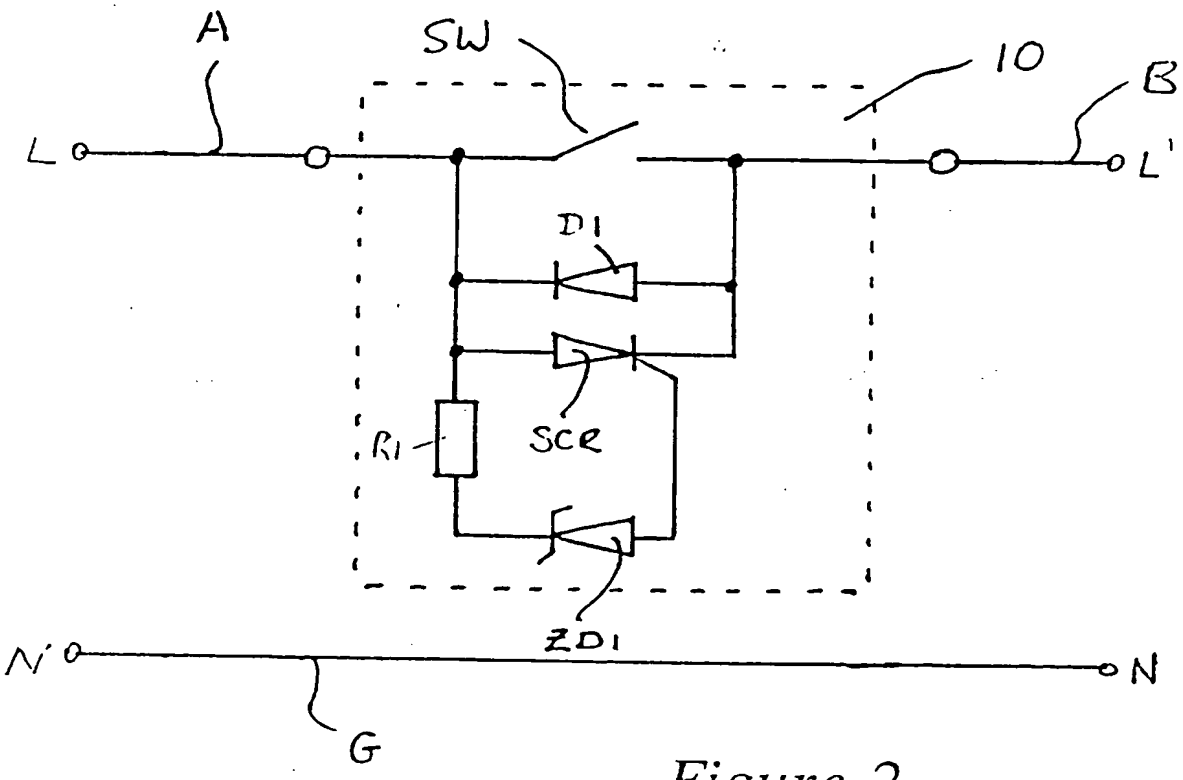


Figure 2

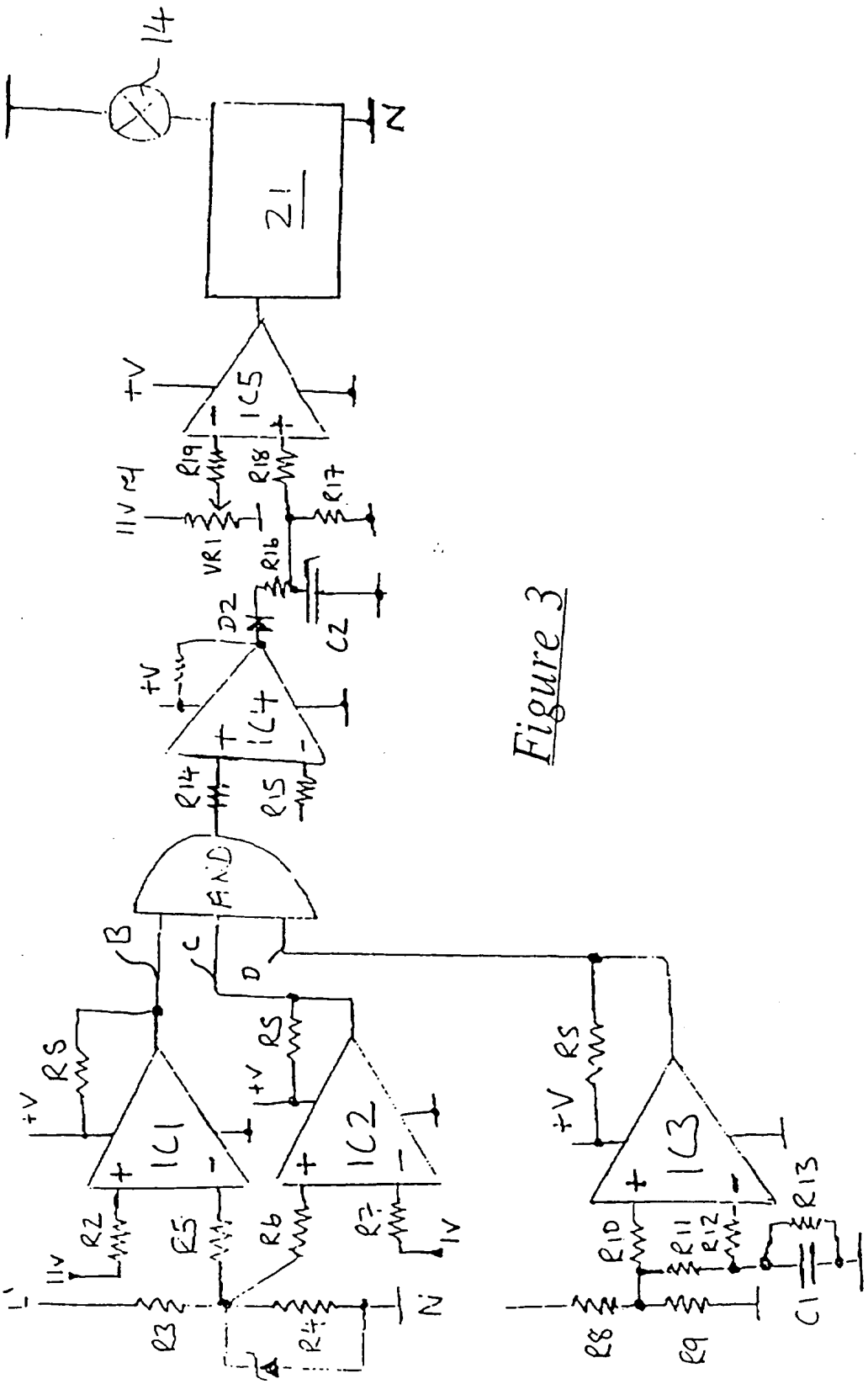
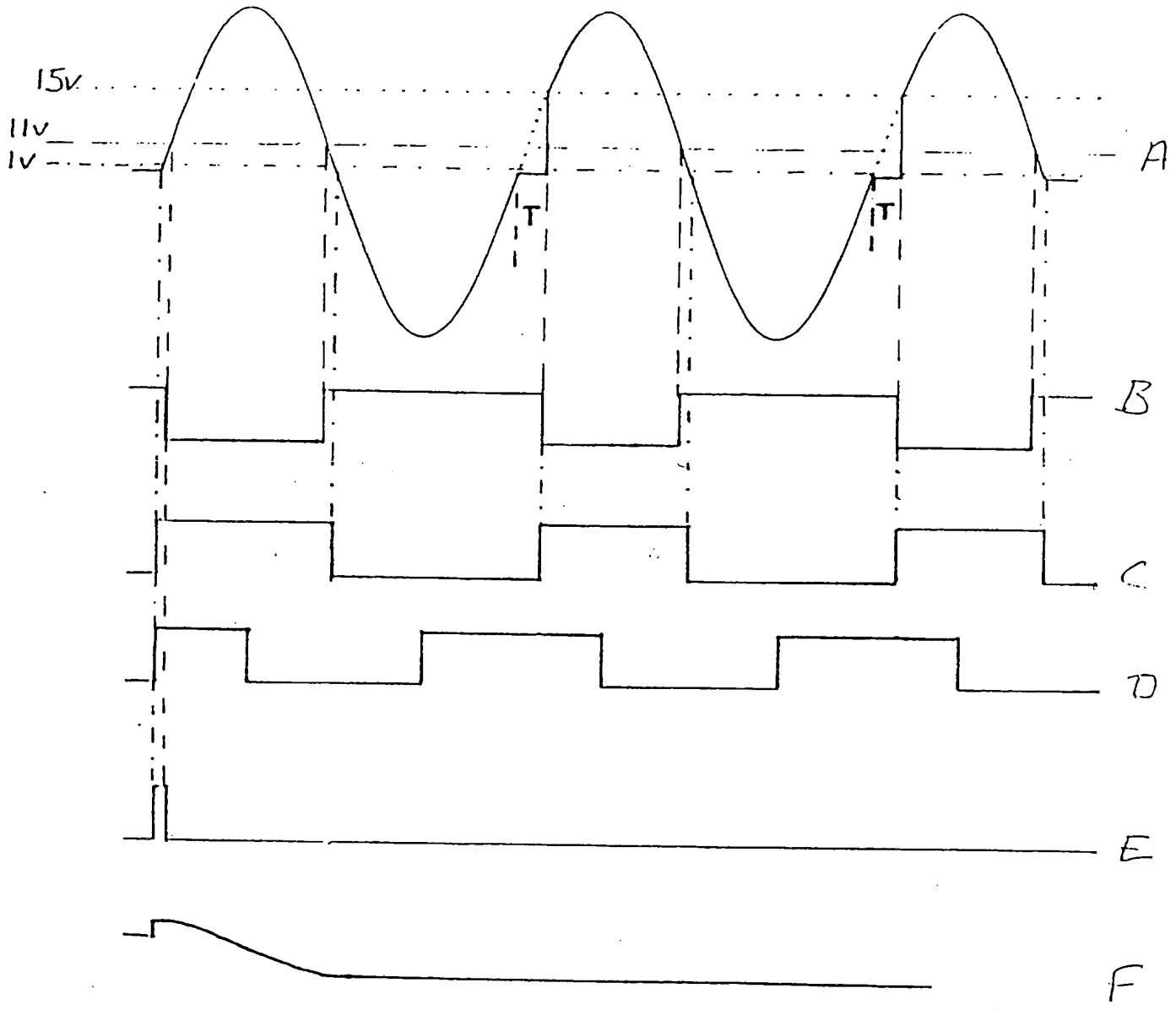

L'
14
N
21
+V
IC5
R19
R18
R17
11V
VR1
R16
C2
D2
IC4
R14
R15
AND
B
C
D
R5
IC1
IC2
IC3
R2
R6
R7
R10
R11
R12
R13
C1
R3
R4
R8
R9
1V
11V

Figure 3



SWITCH CLOSED | SWITCH OPEN
LIGHT ON | LIGHT OFF

Figure 4

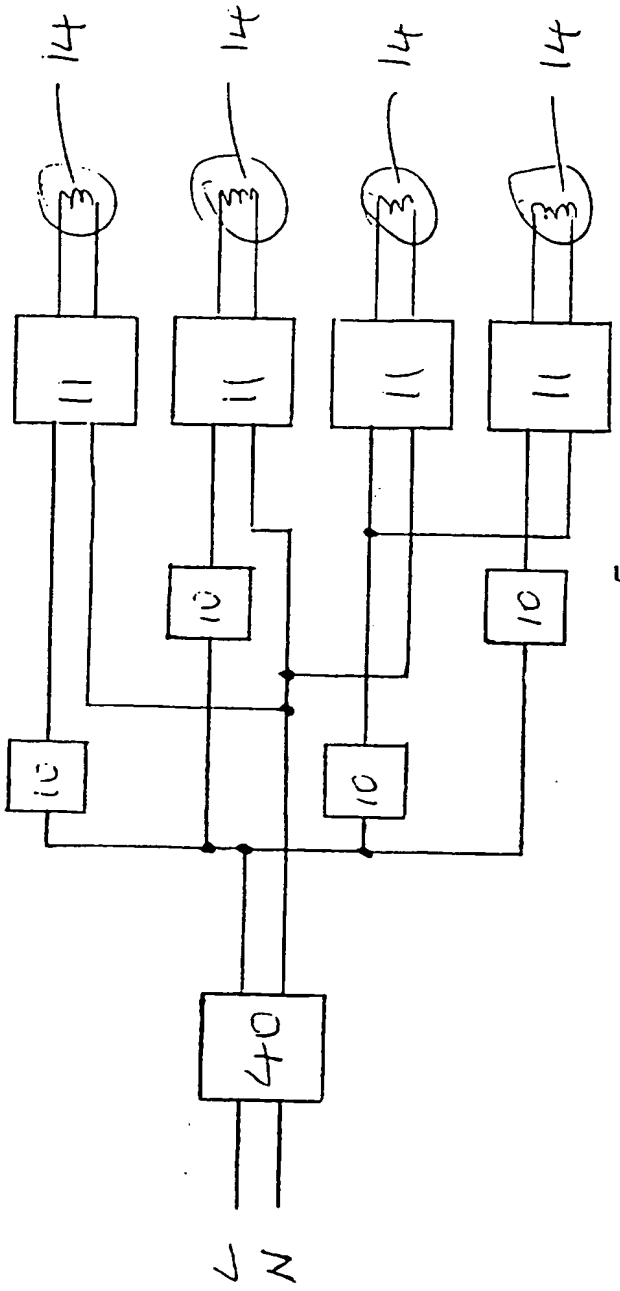


Figure 5

2298553

Remote Control System

This invention relates to a remote control system for remotely controlling appliances connected to the a.c. mains supply.

It is desirable to power smoke alarms from the a.c. mains supply, since conventional battery powered smoke alarms will not operate reliably unless the battery is replaced regularly. A disadvantage of fitting a mains powered smoke alarms to a ceiling in a property is that a constant a.c. mains supply cable has to be routed through to a convenient mounting point on the ceiling. Clearly, it is a problem to route such cables after a property has been constructed.

Most properties comprise a ceiling light fixture which can be used to also supply power to a smoke alarm. However a disadvantage of this arrangement is that the a.c. mains power is removed from the alarm each time the light is turned off.

In order to overcome this problem, it has been proposed to provide a smoke alarm system which comprises a remote control unit and a smoke alarm assembly. The remote control unit replaces a conventional light switch and allows continuous power to pass to the alarm assembly which is mounted on the ceiling. The alarm assembly comprises terminals for connecting to a pendant light. In use, the remote control unit sends signals along the supply cable to the alarm assembly, which comprises a control signal detector unit that selectively connects the light to the supply cable.

In one known arrangement, the control unit superimposes control signals onto the a.c. mains waveform. A disadvantage of this arrangement is that the control unit is bulky, thereby making it difficult to fit the control unit to existing light switch wall boxes.

In an alternative known arrangement, the control unit modifies the a.c. mains waveform to create an imbalance between positive and negative half cycles of the supply. The detector unit in the alarm assembly detects this modification and controls the light accordingly. A disadvantage of this so-called balanced switching arrangement is that the two half cycles of the mains supply need to be the same, otherwise the smoke alarm system will not work reliably. Furthermore, a 1.4%

loss of power occurs to the load when the waveform is modified. Another disadvantage of balanced switching systems is that an earth wire is required to provide a reference, and often earth wires are not used in lighting circuits. In order to prevent small fluctuations in the voltage waveform from triggering the detector unit, the system averages the waveform over several half cycles. The system is thus slow to react to changes in the waveform.

I have now devised a remote control system which alleviates the above-mentioned problems.

In accordance with this invention as seen from a first aspect, there is provided a remote control system for remotely controlling an a.c. mains powered electrical appliance, the system comprising a control unit and a remote detector unit, the control unit being arranged for connecting in series with a cable that extends between the a.c. mains supply and the detector unit, the control unit comprising switch means which can be actuated to interrupt a.c. mains current flow to the detector unit, at least once every main cycle, for a predetermined time period directly after the direction of a.c. current flow reverses, the detector unit being arranged to detect said interruption in the current flowing along the cable to selectively connect the appliance to the cable.

The detector can reliably detect when the waveform is modified since the current is interrupted for a short period directly after the direction of current flow reverses. Thus, the system does not require a high level of main quality to work reliably.

Preferably the control unit is arranged to interrupt the a.c. mains current flow for less than one half cycle of the mains supply, so that substantially full power is delivered to the detector unit when the switch is activated.

It will be appreciated that the system in accordance with this invention operates independently of the absolute value of the mains supply, and is thus less susceptible to fluctuations in the mains supply. The interruption in the current can easily be detected using simple low cost components. The detector unit reacts within one cycle to interruptions in the current waveform. If the current is

interrupted whilst the positive half cycle of the mains supply is between 0-15 volts, then the power available will only by 0.08% less than full wave mains current.

In one embodiment, the control unit normally allows full wave a.c. mains current to flow to the detector until the switch means is actuated.

Preferably the detector unit is arranged to connect said appliance to the cable when full wave a.c. mains current is flowing along the cable. In this manner the appliance is powered by the full wave a.c. mains supply rather than by an interrupted supply.

In an alternative embodiment, the control unit is arranged to change the amount of time which it interrupts the a.c. mains current flow when said switch is actuated, the detector unit being arranged to detect this change in interruption time to selectively connect the appliance to said cable.

Preferably the detector unit is arranged to selectively connect a light to said cable.

Preferably the detector unit is incorporated within a smoke alarm assembly having a smoke alarm unit, the smoke alarm unit being continuously powered from said cable.

It is desirable that all smoke alarms in a building are interconnected, so that if one detects smoke it will trigger all of the other alarms and switch on their associated light. Hitherto, smoke alarms have been interconnected by physically running a signal wire between each of the alarms. If the building has already been constructed then it is difficult to interconnect the alarms without running the wire externally of the walls and ceilings, which can be unsightly.

Thus, preferably the smoke alarm unit of the assembly is arranged to apply an alarm signal to the cable when the a.c. mains current is normally interrupted, said alarm signal being arranged to trigger other smoke alarm assemblies. The alarm signal mat comprise a d.c.level or pulse, or an a.c. signal.

Preferably the system comprises an interconnect unit arranged for connecting in series with a plurality of cables feeding smoke alarm assemblies and the mains supply, the

interconnect unit being arranged to detect an alarm signal from a triggered alarm assembly to trigger other smoke alarms assemblies that are connected thereto.

Preferably the interconnect unit is arranged to trigger the alarm assemblies by interrupting the a.c. mains current flow to the assemblies, at least once every mains cycle, for a predetermined time period directly after the direction of current flow reverses, the interruption period being different from the interruption period used to control said appliance.

In accordance with this invention as seen from a second aspect, there is provided a remote control system for remotely controlling an electrical appliance, the system comprising a control unit and a remote detector unit, the control unit being arranged for connecting in series between a first conductor connected to the a.c. mains supply and a second conductor connected to the remote detector unit, the control unit comprising switch means having a first configuration for connecting the first conductor directly to the second conductor, so that a full a.c. mains current flows through the detector, and a second configuration in which the first conductor is connected to the second conductor via a current modifying means, the current modifying means being arranged to block a.c. mains current flow in one direction along the second conductor when the direction of current flow reverses, the current modifying means being arranged to enable current flow in said direction a predetermined time period after the direction of current flow has reversed, the detector unit being arranged to detect the modified current to control an electrical appliance powered from said second conductor.

The current modifying means may be arranged to block either the positive or negative half cycles of current flow for a predetermined time period when the current flow reverses. However, any large loads on this modified current waveform will load one half cycle of the mains supply more than the other half. Thus, the current modifying means may be arranged to block current flow during both positive and negative half cycles for a predetermined time period each time the current flow reverses, so that a balanced current is drawn from the supply.

Preferably the detector unit is arranged to selectively turn the appliance ON and OFF in response to the full mains current and modified mains current.

Preferably the current modifying means comprises a thyristor such as a silicon-controlled rectifier (SCR) or a triac.

Preferably the thyristor is controlled to enable current flow in said direction when the mains supply voltage exceeds a predetermined control voltage. Preferably the thyristor is controlled by a zener diode.

Preferably the detector unit is arranged to provide a first signal when the voltage on the second conductor falls below a first voltage reference level, and a second signal when the voltage on the second conductor exceeds a second voltage reference level, the second voltage reference level being of a lower magnitude than the first voltage reference level, the first and second voltages being of a lower magnitude than said predetermined control voltage, the detector unit being arranged to provide an output signal when the first and second voltages are simultaneously detected.

Thus, when the current is not modified the output from the detector goes high for a short period once every cycle of the mains supply i.e. when the mains voltages exceeds the second reference level and lies below the first reference level. However, when the waveform is modified the first and second signals do not occur simultaneously, and hence no output from the detector occurs. The presence or absence of this signal can be detected to control the electrical appliance accordingly.

Preferably the detector is arranged to provide a third signal, in order to determine whether modification occurs during a positive to negative mains voltage transition or vice-versa.

Also in accordance with this invention as seen from a third aspect, there is provided a control unit for connecting in series between a first conductor connected to an a.c. mains supply and a second conductor connected to a remote detector unit, the control unit comprising switch means having a first configuration for connecting the first conductor directing to

the second conductor, so that a full a.c. mains current flows to the detector, and a second configuration in which the first conductor is connected to the second conductor via current modifying means, the current modifying means being arranged to block a.c. mains current flow in one direction along the second conductor when the direction of current flow reverses, the current modifying means being arranged to enable current flow in said direction a predetermined time period after the direction of current flow has reversed.

Further in accordance with this invention as seen from a fourth aspect, there is provided a detector unit arranged to receive an a.c. mains current over a conductor and detect whether a full a.c. mains current flows along said conductor, or whether a modified current flows along said conductor, the modified current exhibiting interruptions of the current flow in one direction when the direction of current flow has reversed, the detector unit being arranged to detect the modified current to control an electrical appliance powered from said conductor.

Embodiments of this invention will now be described by way of examples only, and with reference to the accompanying drawings, in which:

FIGURE 1 is a block diagram of an embodiment of smoke alarm system in accordance with this invention;

FIGURE 2 is a schematic diagram of a control unit of the alarm system of Figure 1;

FIGURE 3 is a schematic diagram of a control signal detector unit of the alarm system of Figure 1;

FIGURES 4A-4F are waveform diagrams to explain the operation of the control unit of Figure 2 and the signal detector unit of Figure 3; and

FIGURE 5 is a block diagram of an alternative embodiment of smoke alarm in accordance with this invention.

Referring to Figure 1 of the drawings, there is shown a smoke alarm system for fitting to a conventional lighting circuit in a room. The system comprises a control unit 10 that replaces the conventional light switch, and a smoke alarm assembly 11 that replaces the conventional ceiling rose or light fitting. The control unit 10 is connected in series with

a wire A that carries the mains live supply L and an existing wire B that used to carry the switched live supply L' from the wall switch to the ceiling rose. The alarm assembly 11 is connected to the L' wire B and a second wire G which carries the mains neutral supply N.

The alarm assembly 11 comprises a smoke alarm unit 12 and a control signal detector unit 13 mounted inside a plastics housing which resembles a conventional ceiling rose. The smoke alarm and signal detector units 12,13 are each connected to both the wires B,G of the supply cable. The detector unit 13 comprises terminals for connecting to a pendant light 14, the detector unit 13 being arranged to connect the light 14 to the supply wires B,G when appropriate signals are received from the control unit 10, as will be described below.

Referring to Figure 2 of the drawings, the control unit 10 comprises a switch SW having one terminal connected to the wire A that carries the mains live supply L and a second terminal connected to the wire B that connects to the alarm assembly 11. A diode D1 and a silicon-controlled rectifier SCR are connected in inverse parallel across the terminals of the switch SW. The cathode of a zener diode ZD1 is connected to the anode of the SCR via a resistor R1. The anode of ZD1 is connected to the gate of the SCR, the cathode of the SCR being connected to the wire B.

Referring to Figure 3 of the drawings, the detector unit 13 comprises a first comparator IC1 having its non-inverting input connected to an 11v reference voltage via a resistor R2. A pair of resistors R3,R4 are connected across the terminals of the alarm assembly that are connected to the supply wires B,G respectively. The junction between the resistors R3,R4 is connected to the inverting input of comparator IC1 and to the non-inverting input of a second comparator IC2. A 12v zener diode ZD2 is connected in parallel with R4, its cathode terminal being connected to the inverting inputs of the two comparators IC1, IC2. The non-inverting input of IC2 is connected to a 1v reference voltage.

A second pair of resistors R8,R9 are also connected in series across the terminals of the alarm assembly that are connected to the supply wires B,G respectively. The junction

between the two resistors R8,R9 is connected to the non-inverting input of comparator IC3 via a resistor R10. The junction is also connected to the inverting input of comparator IC3 via a series connection of two resistors R11,R12. The junction between R11 and R12 is connected to ground via a capacitor C1. A resistor R13 is connected in parallel across capacitor C1. The outputs of each of the comparators are strapped to a positive d.c. supply +v via respective resistors RS. Each output is connected to respective input terminals of an AND gate.

The output from the AND gate is connected to the non-inverting input of a fourth comparator IC4 via a resistor R14. A 1v reference voltage is connected to the inverting input of comparator IC4.

The output of comparator IC4 is connected to the anode of a diode D2. The cathode of the diode D2 is connected to ground via a resistor R16 and a parallel connection of a capacitor C2 and a resistor R17. The junction between the resistor R16 and the parallel resistor and capacitor R17,C2 is connected to the non-inverting input of a fifth comparator IC5.

The inverting input of IC5 is connected via a resistor R19 to the wiper of a variable resistor VR1, which is connected between an 11v reference voltage and ground. The output of comparator IC5 is connected to a switching circuit 21 comprising a normally-closed switch, which is arranged to connect the light across the two supply wires B,G.

The operation of the control unit 10 will now be described with reference to Figure 4A of the drawings. When the switch SW is closed, both half cycles of the mains supply flow to the smoke alarm assembly 11. The output of comparator IC5 in the detector unit 13 is low, and thus the normally-closed switch contacts in the switching circuit 21 remain closed thereby applying the full a.c. mains power on the wires B,G to the light 14.

In order to remove power from the light 14, the switch SW is opened. The diode D1 conducts during negative half cycles of the supply. However, during positive half cycles D1 is reverse biassed, so that forward current flow is blocked. Once the voltage of the positive half cycle exceeds the

breakdown voltage of the zener diode ZD1, then the SCR is driven into conduction, so that current can flow in the forwards direction during the remainder of the positive half cycle. The SCR turns off once its cathode voltage exceeds its anode voltage i.e. when the supply reverses.

It will be appreciated that the zener diode ZD1 drives the SCR into conduction a short time period T after the supply on wire A goes from negative to positive. The duration of this time period T is governed by the breakdown voltage V_{Z1} of the zener diode ZD1. In the example shown, the breakdown voltage is in the region of 15 volts.

Thus, a modified a.c. supply is fed to the alarm assembly 11 when the switch SW is opened.

The operation of the signal detector unit 13 of Figure 3 will now be described with reference to Figures 4B to 4F. The modified a.c. waveform is fed to each of the comparators IC1 to IC3. Comparator IC1 is arranged such that the voltage on its output B goes high when the voltage of the waveform is less than 11 volts, as shown in Figure 4B. Comparator IC2 is arranged such that the voltage on its output C goes high when the voltage of the waveform is greater than 1 volt, as shown in Figure 4C. The parallel connection of C1 and R13 serves to provide a voltage on the inverting input of comparator IC3 which follows the voltage on the non-inverting input. Thus the voltage on the output C of comparator IC3 is only high when the voltage of the waveform is rising. For simplicity, the waveforms of Figures 4B-D are shown as square waves.

The output of each of the comparators is fed to respective inputs of the AND gate. It will be appreciated that when the waveform is not modified the outputs of all the comparators are only high between 1 and 11 volts on a positive going half cycle. Thus, the output E of the AND gate is pulsed as shown in Figure 1E.

When the waveform is modified, there is no time at which all three outputs B,C,D of the comparators IC1-IC3 are high. Thus, no signal appears on the output E of the AND gate.

The output E of the AND gate is fed to IC4 which acts as a buffer in order to increase the fan out of the AND gate. Any pulses on the output of IC4 charge capacitor C2. The

voltage on the non-inverting input F to comparator IC5 thus falls when the pulses are not present i.e. when the waveform is modified. The voltage on the output of comparator IC5 goes high when the voltage on its non-inverting input F exceeds the reference voltage which is set by VR1. Thus, the output of comparator IC5 is high when the waveform is modified, so that the normally-closed switch contacts in the switch circuit 21 open to disconnect the supply to the light 14.

It will be appreciated that the light 14 is off when the voltage supply to the assembly is modified, and on when the voltage supply to the assembly is not modified i.e. purely sinusoidal. The smoke alarm unit 12 is continuously powered, since when the light is on the alarm is powered by the unmodified supply, and when the light is off the alarm is powered by the modified supply.

It can be seen that the light 14 is powered by a substantially balanced mains supply, and thus one half of the cycle is not loaded any more than the other half. The smoke alarm unit draws a low current, and thus there is a negligible current imbalance between positive and negative half cycles of the mains supply.

The control unit 10 may comprise an additional SCR to modify the negative half cycle in a similar manner. Thus, an additional control function may be provided by providing additional comparator circuits to detect this modification also. Further control functions may be provided by selectively switching different values of zener diodes in circuit in the control unit 10. The resultant change in the output waveform can be detected using comparator circuits in the signal detector unit 13 which examine whether or not a different waveform is present.

Referring to Figure 5 of the drawings, there is shown an alternative embodiment of smoke alarm system and like parts and given like reference numerals. The system comprises a plurality of smoke alarm assemblies 11 connected in parallel across the mains supply conductors L,N. As described above, the live conductor to each assembly 11 is connected in series with respective control units 10 that modify the mains flowing to the alarm assemblies, in order to control their respective

lights 14. A master interconnect unit 40 is connected in series with the mains supply feeding each control unit 10 and alarms 11.

In practice, the interconnect unit may be situated in series with the mains supply between the fuse box or consumer unit and the lighting circuit.

In use, the interconnect unit modifies the mains by creating a permanent interruption the supply for a period of about 60μS after the negative to positive transition of the mains supply. This is achieved using a circuit similar to the control unit of Figure 2 and a 5 volt zener diode.

In order to turn their respective light OFF each control unit extends the duration of the interruption by switching a 15 volt zener diode ZD1 in series with the supply. If one of the smoke alarm assemblies detects smoke it applies a d.c. alarm voltage to the a.c. waveform in the period when the supply is inhibited. The interconnect unit 40 continuously monitors the neutral wire of the supply to the alarms 11 to determine whether any current is flowing in the 60μS time period just after the negative to positive supply transition. Normally, no current would be flowing in this period, however under an alarm condition a current flow is detected owing to the d.c. alarm voltage which has been added by the activated alarm 11.

The interconnect unit 40 detects this current flow and increases the length of time which it interrupts the mains supply by switching a 20 volt zener diode in series with the existing 5 volt zener diode. Each of the alarms 11 detect this increase in supply interruption and enter a test mode in which their sounders and lights 14 operate.

It will be appreciated that the supply interruption period T for the alarms 11 to enter their test mode is longer than the period used by the control units 11 to turn the lights off. Obviously, the provision of an extra interruption period to provide a test function requires an extra comparator stage in the detector unit of each alarm 11.

The control periods to the alarm can thus be summarised as follows:

ZENER VOLTAGE	PERIOD (T)	FUNCTION
5V	60μS	LIGHT ON
15V	200μS	LIGHT OFF
20V	277μS	TEST
30V	413μS	ALARM SILENCE

Claims

1) A remote control system for remotely controlling an a.c. mains powered electrical appliance, the system comprising a control unit and a remote detector unit, the control unit being arranged for connecting in series with a cable that extends between the a.c. mains supply and the detector unit, the control unit comprising switch means which can be actuated to interrupt a.c. mains current flow to the detector unit, at least once every mains cycle, for a predetermined time period directly after the direction of current flow reverses, the detector unit being arranged to detect said interruption in the current flowing along the cable to selectively connect the appliance to the cable.

2) A remote control system as claimed in claim 1, in which the control unit is arranged to allow full wave a.c. mains current to flow to the detector unit until the switch means is actuated.

3) A remote control system as claimed in claim 2, in which the detector unit is arranged to connect said appliance to the cable when said full wave a.c. mains current is flowing to the detector unit.

4) A remote control system as claimed in claim 1, in which the control unit is arranged to alter the interruption period when said switch is actuated, the detector unit being arranged to detect for a change in the interruption period to selectively connect said appliance to the cable.

5) A remote control system as claimed in claim 1, in which the detector unit is incorporated within a smoke alarm assembly having a smoke alarm unit, the smoke alarm unit being continuously powered from said cable.

6) A remote control system as claimed in claim 5, in which the smoke alarm unit of the assembly is arranged to apply an

alarm signal to the cable in the period when the a.c. mains current is interrupted, said alarm signal being arranged to trigger other smoke alarm assemblies.

7) A remote control system as claimed in claim 6, comprising an interconnect unit arranged for connecting in series between a plurality of cables feeding respective smoke alarm assemblies and the mains supply, the interconnect unit being arranged to detect an alarm signal from a triggered alarm assembly and to trigger other smoke alarm assemblies that are connected thereto.

8) A remote control system as claimed in claim 7, in which the interconnect unit is arranged to trigger said other alarm assemblies by interrupting the a.c. mains current flow along their respective cables, at least once every mains cycle, for a predetermined time period directly after the direction of current flow reverses, the interruption period being different from the interruption period used to control said appliance.

9) A remote control system for remotely controlling an electrical appliance, the system comprising a control unit and a remote detector unit, the control unit being arranged for connecting in series between a first conductor connected to the a.c. mains supply and a second conductor connected to the remote detector unit, the control unit comprising switch means having a first configuration for connecting the first conductor directly to the second conductor, so that a full a.c. mains current flows through the detector, and a second configuration in which the first conductor is connected to the second conductor via a current modifying means, the current modifying means being arranged to block a.c. mains current flow in one direction along the second conductor when the direction of current flow reverses, the current modifying means being arranged to enable current flow in said direction a predetermined time period after the direction of current flow has reversed, the detector unit being arranged to detect the modified current to control an electrical appliance powered from said second conductor.

10) A remote control system as claimed in claim 9, in which the current modifying means is arranged to block either the positive or negative half cycles of current flow for a predetermined time period when the current flow reverses.

11) A remote control system as claimed in claim 9, in which the current modifying means is arranged to block current flow during both positive and negative half cycles for a predetermined time period each time the current flow reverses.

12) A remote control system as claimed in claim 9, in which the detector unit is arranged to selectively turn the appliance ON and OFF in response to the full mains current and modified mains current.

13) A remote control system as claimed in claim 9, in which the current modifying means comprises a thyristor.

14) A remote control system as claimed in claim 13, in which the thyristor is controlled to enable current flow in said direction once the mains supply voltage exceeds a predetermined control voltage.

15) A remote control system as claimed in claim 14, in which the thyristor is controlled by a zener diode.

16) A remote control system as claimed in claim 14, in which the detector unit is arranged to provide a first signal when the voltage on the second conductor falls below a first voltage reference level, and a second signal when the voltage on the second conductor exceeds a second voltage reference level, the second voltage reference level being of a lower magnitude than the first voltage reference level, the first and second voltages being of a lower magnitude than said predetermined control voltage, the detector unit being arranged to provide an output signal when the first and second voltages are simultaneously detected.

17) A remote control system as claimed in claim 16, in

which the detector unit is arranged to provide a third signal, in order to determine whether modification occurs during a positive to negative mains voltage transition or vice-versa.

18) A remote control system as claimed in claim 9, comprising a smoke alarm assembly which comprises the detector unit and a smoke alarm unit, the smoke alarm unit being continuously powered from said second conductor, the detector unit being arranged to control a light powered from said second conductor.

19) A remote control system substantially as herein described with reference to Figures 1 to 4 or Figure 5 of the accompanying drawings.

20) A control unit for connecting in series between a first conductor connected to an a.c. mains supply and a second conductor connected to a remote detector unit, the control unit comprising switch means having a first configuration for connecting the first conductor directing to the second conductor, so that a full a.c. mains current flows to the detector, and a second configuration in which the first conductor is connected to the second conductor via current modifying means, the current modifying means being arranged to block a.c. mains current flow in one direction along the second conductor when the direction of current flow reverses, the current modifying means being arranged to enable current flow in said direction a predetermined time period after the direction of current flow has reversed.

21) A control unit substantially as herein described with reference to Figures 1 to 4 or Figure 5 of the accompanying drawings.

22) A detector unit arranged to receive an a.c. mains current over a conductor and detect whether a full a.c. mains current flows along said conductor, or whether a modified current flows along said conductor, the modified current exhibiting interruptions of the current flow in one direction

when the direction of current flow has reversed, the detector unit being arranged to detect the modified current to control an electrical appliance powered from said conductor.

23) A detector unit substantially as herein described with reference to Figures 1 to 4 or Figure 5 of the accompanying drawings.

The Patent Office

18

Application No: GB 9603562.1 **Examiner:** M J Billing
Claims searched: 1 to 23 **Date of search:** 10 May 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4H HRCR, HRCS; H2H HLL4, HSL, HSS; H4R RTC, RTSR.

Int Cl (Ed.6): G08B 25/06; H02J 3/14, 13/00; H04B 3/54; H05B 37/00, 37/02, 39/00, 39/02, 39/04, 39/06.

Other: ONLINE : WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X; Y	GB2197568A	(PITTWAY) - Figs.1,2,4; Abstract, page 3 lines 51-55, page 4 line 110 to page 5 line 1	1,2,9, 10-15,20,22; 5,18 at least
X; Y	GB2083301A	(SOUTH EASTERN ELECTRICITY) - Abstract, page 2 lines 42-53, page 4 lines 40-53	9,10,20, 22; 18 at least
X; Y; P	EP0645870A1	(CUBIZOLLES) - Fig.1; Abstract	1,2,4,9, 10,20,22; 5,18 at least
Y	WO93/17482A3	(SCANTRONIC) - Abstract	5,18 at least
X;Y	WO92/06552A1	(MOTOROLA) - Abstract	9,20,22; 5,18 at least
X; Y	WO80/01024A1	(MEDIBIT) - Fig.2A; Abstract	9,20,22; 5,18 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

19

Application No: GB 9603562.1 **Examiner:** M J Billing
Claims searched: 1 to 23 **Date of search:** 10 May 1996

Category	Identity of document and relevant passage		Relevant to claims
X;Y	US4719446	(CASABLANCA FAN) - Figs.2,4; Abstract, column 5 line 4 to column 6 line 43	1,2, 9-13, 20,22; 5,18 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.